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Of the various preparations proposed for the inoculation of fields, the dried cultures of MOORE and of BOTTOMLEY are absolutely useless; it is certain that they either do not contain the tubercle organism at all, or it is in such condition as to be unable to show its action in any way. As to the efficacy of fresh cultures (like the nitrage of HILTNER) opinions are not unanimous, and one cause of the uncertainty of the results may be that the culture is eventually impure.

In soils without tubercle bacteria those properly isolated by DE'ROSSI from the same species of host have given him good results in increased crops and added proportion of nitrogenous content. The manner of infection has had no effect, and he has not been able to discover any such unfavorable influence as was attributed by HILTNER and STORMER to substances in the soil or on the seed at the time of germination. From negative results DE'ROSSI doubts the possibility (affirmed by some) of improving the crop by inoculation when the soil already contains the organism. In another paper of the same title (included in above citation) DE'ROSSI asserts that in his cultures, certainly pure and surely identified as the tubercle bacillus, no fixation of free nitrogen has taken place. As this is not observed in the tubercle until the bacteroids are formed, and as few bacteroids are formed in cultures, the result appears quite proper. Evidently the questions raised will require new examination.—C. R. B.

**Evolution of fungi.**—The construction of a phylogenetic system for the fungi has always been peculiarly difficult on account of the heterogeneity of the group and the lack of common characters uniting the forms into evolutionary series. Two theories have generally been suggested; one regarding the fungi as an autonomous group, and the other regarding them as offshoots from various groups of algae. Among the adherents of the algal theory of descent, a favorite method of treating the lower Phycomycetes (or Chytridiales) has been to consider them as forms derived from the higher Phycomycetes through the degenerating influence of parasitism.

ATKINSON<sup>14</sup> in dealing with the evolution of this group favors the view that the Phycomycetes constitute an ascending evolutionary series. In support of this view he points out that the favorite method of accounting for the lower forms is fallacious, for whatever evolution occurred among the fungi took place after they had acquired a parasitic or saprophytic mode of life. Parasitism and saprophytism, therefore, were general modes of life under which the whole group existed, and hence cannot be invoked as special factors to account for particular minor offshoots. Another argument for the unity of the group is found in the phenomenon of diplanetism, that is, the occurrence of two swarming periods of the zoospores. Although this phenomenon is most clearly developed in the Saprolegniales, the author believes it occurs in a primitive state in the Chytridiales, in some of which the protoplasm breaks up into the sporangium, where after an interval the zoo-

<sup>14</sup> ATKINSON, G. F., Some problems in the evolution of the lower fungi. *Annal. Mycol.* 7:441-472. figs. 20. 1909.

spores are differentiated and set free. The first partial differentiation and movement of the spore-origins is regarded as the counterpart of the first swarming period of the zoospores of the Saprolegniales. This view derives diplanetism from a more primitive state among the lower fungi, while there is nothing among the algae which corresponds to the phenomenon.

It is further pointed out that some other phenomenon, such as heterogamy, isogamy, and the proliferation of the sporangium, each have a primitive counterpart among the Chytridiales, and can be traced in a natural series to the Saprolegniales and Oomycetes. For some of the phenomena, like the proliferation of the sporangium, there is no counterpart whatever among the algae.—H. HASSELBRING.

**Cultures of Uredineae.**—In continuation of the long series of experiments in his cultural work on the Uredineae, the cultures made in 1908 have been reported by ARTHUR.<sup>15</sup> The most interesting result of the work of that year is the discovery that the aecidial stage of *Gymnosporangium externum* Arthur and Kern (described as new) occurs on a herbaceous perennial, *Porteranthus stipulatus* (Muhl.) Britton. This is the only case known of the occurrence of an aecidium of *Gymnosporangium* on a plant outside of the Pomaceae. Another unusual case is that of *G. Libocedri* (P. Henn.) Kern, whose aecidial stage is shown to be *Aecidium Blasdaleanum* D. and H., a true aecidium and not belonging to the *Roestelia* type as in all other *Gymnosporangia*. Series of cultures with 13 species of rusts gave negative results, and cultures with 23 species confirmed and supplemented work previously reported. The relations of the following species have been worked out for the first time: *Puccinia absinthii* DC. on *Artemisia dracunculoides* Pursh has no aecidia, but has pycnidia on the same host; *P. macrospora* (Peck) Arthur on *Carex comosa* Boott sown on *Smilax hispida* Muhl.; *P. patruclis* Arth. on *Carex pratensis* Dreej. sown on *Agoseris glauca* (Pursh) Green; *P. cinerea* Arth. on *Puccinellia airoides* (Nutt.) Wats. and Coult. sown on *Oxygraphis cymbalaria* (Pursh) Prantl; *P. Koeleriae* Arth. on *Koeleria cristata* (L.) Pers. sown on *Mahonia aquifolium* (Pursh) Nutt.; *P. alternans* Arth. on *Bromus Porteri* (Coult.) Nash sown on *Thalictrum dioicum* L.; *P. obliterated* Arth. on *Agropyron biflorum* R. and S. sown on *Aquilegia canadensis* L.; *P. Muhlenbergiae* Arth. and Holw. on *Muhlenbergia glomerata* Trin. sown on *Callirhoe involucrata* (T. and G.) A. Gray; *Gymnosporangium Libocedri* (P. Henn.) Kern on *Libocedrus decurrens* Torr. sown on *Crataegus Pringlei* Sarg.; and *G. externum* Arth. and Kern on *Juniperus virginiana* L. sown on *Porteranthus stipulatus* (Muhl.) Britt.—H. HASSELBRING.

**Biology of *Gymnosporangium*.**—Another interesting example showing the slight degree of differentiation existing among some species of parasitic fungi

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<sup>15</sup> ARTHUR, J. C., Cultures of Uredineae in 1908. *Mycologia* 1:225-256. 1909.